

# Quartz Fiber Filters

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## (1) GENERAL INFORMATION

QAO quartz fiber filters (cat. no. 2500 QAO) are available from Pallflex Corp, phone (203)928-7761. We typically order two sizes: 47 mm diameter filters for use in our ambient filter holders and 102 mm diameter filters for use in the hi-vol dicot samplers. (A second type of high volume sampler also exists which uses rectangular (8 x 10 inch) filters.

Before use the filters must be prepared and stored such that the organic carbon and elemental carbon blank values are low, and care must be used in handling the filters. It is desirable to prepare baked aluminum foil to use as a work surface on the lab bench. Work in the clean, hepa-filtered lab in room 10 unless space prohibits it. Procedures for preparing the two sizes of quartz filters are slightly different.

## (2) PROCEDURE FOR BAKING QUARTZ FILTERS

### Preparing large (102mm) Quartz filters

For 102 mm diameter filters, first prepare individual foil pouches that will be used to store the filters before use in the field. Use two layers of aluminum foil for each pouch to add extra insurance against punctures to the package. Aluminum foil is available at Caltech. I usually get it at the Biology Stockroom.

Make a pouch that is just slightly larger than the filter. Use a scrap filter as an aid to judging how large to make the pouches. Fold the edges of the foil on three sides leaving the fourth side open for air to circulate in the interior of the pouch. After making 50-100 pouches use additional aluminum foil to make a baking tray to hold the pouches standing vertically in the oven with their open sides on top, uncovered. Be careful that none of the foil touches the side or top of the oven or it will burn.

Bake foils at 550°C for 6-8 hours, or overnight for convenience. This baking will remove organic residues acquired by aluminum foil during its manufacture. After allowing the foils to cool in the oven, store them in the clean room.

Use only clean, solvent-rinsed tweezers to touch the filters, and try only to touch their edges. Do not use any filters that have any visible imperfections. Place individual filters in the pre-baked aluminum foil pouches being careful not to fold or puncture the filters. Seal the 4th edge before baking.

It is preferable to prepare filters in batches of approximately 100. Each time a set of filters are baked enter the relevant information onto the filter prep. log sheet. This information includes the lot number from the box of filters, the Caltech assigned batch number (e.g., Q-19), the date, time, and temperature baked. A new batch number is assigned for each batch of filters prepared.

Filters are baked at 550°C for approximately 16 hours. This includes approximately 2 hours for the oven to heat to 550°C. Also bake several additional

sheets of aluminum foil to later be used for wrapping the prepared filters or as work surfaces in the lab. Fold these additional sheets of foil several times so that they will fit in the oven.

Cool filters in the oven by turning the power off and opening the oven door. It is important for filters to be sealed during the cooling process to avoid them picking up contamination from the ambient air during the cooling period. Volatile organics will be able to escape from the aluminum foil packets at high temperature.

Transfer filters from the oven to the clean room as soon as they have cooled enough to handle. Individually packaged filters should be wrapped in groups of 10 in additional annealed aluminum foil and stored in the clean room until needed. The packets should be labelled with the Batch number for later identification.

Set aside approximately 10% of the filters from each batch to later be used as project blanks and clearly identify the batch number the filters are from on both blanks and filters for use in the field.

### **Preparing small (47mm) Quartz filters**

For small, 47 mm diameter quartz filters, use annealed glass jars covered with aluminum foil to hold filters while baking. The glass jars are the same 8oz jars that are used for collecting the hi vol filters. Jars should be cleaned and pre-baked in advance.

Place approximately 50 47mm diameter quartz filters in each jar. Filters should be handled touching only the edges using tweezers. It is desirable to separate all of the filters which come stuck together in boxes.

Stack the filters loosely in the jar then cover the top of the jar tightly with a double layer of annealed aluminum foil. Place several jars of filters into the oven at one time. Or it is also possible to bake a jar or two containing filters at the same time that a set of empty jars are being baked. All are baked at the same temperature, 550°C and the filters should be baked for 16-20 hours.

Complete the filter prep. log sheet with the same information that was needed for large quartz filters: filter lot number, Caltech batch number, date, time, temperature baked, etc.

After baking, allow the jars with filters to cool in the oven with the door ajar until they can be handled. As soon as the jars are cool enough to touch remove them and replace the foil cover with a black lid containing a solvent washed teflon lid liner. Cover the jars tightly and note the batch number on a label on the jar lid. Place the jars with baked filters in the clean room until they have been sealed into prepared petri dishes described below.

### **(3) PETRI DISHES FOR BAKED 47mm QUARTZ FILTERS**

Prepared petri dishes consist of annealed aluminum foil press-fitted into the top and bottom of plastic petri dishes (VWR, cat. no. 25388-606).

Prepare the foil liners by cutting circular pieces of aluminum foil using the bottom wide edge of a petri dish as a template. Cut many aluminum circles, 2 per petri dish plus extras for any that tear during later processing.

Make an aluminum foil boat and fill it with foil circles. Cover the boat and anneal the aluminum foil circles in the oven for approximately 10-12 hours at 550°C.

After the aluminum foil circles have cooled, handle the foils using only clean, solvent-rinsed tweezers. Prepare a clean work area on a lab bench by laying down large pieces of annealed aluminum foil. Open plastic petri dishes and lay out 8-10 at a time.

Press the circular aluminum foil pieces, one at a time, into the tops and bottoms of the petri dishes with the lucite cylinder that was machined to be slightly smaller than the inside diameters of the petri dish tops and bottoms.

Place one baked quartz filter in each prepared petri dish and close it. Seal the edges of the petri dish by stretching Teflon tape around the bottom edge of the petri dish. Store these in a petri dish holder at room temperature in the clean room or in a freezer until used for sampling. Make sure all of the petri dishes are well sealed with teflon tape.

#### (4) CLEANING JARS FOR 102mm QUARTZ FILTERS

Individual 8 oz jars ordered from VWR (cat. no. 16195-088) are used to collect the large 102mm diameter quartz filters after sampling.

Everything that comes into contact with the large quartz filters needs to be extremely carefully prepared to be free of any organic contamination. Baking at 550°C is a good way to remove organic contaminants. However, the jar lids are plastic with cardboard liners and can not be baked. The jar lids will later be lined with teflon lid liners. Teflon can not be baked and should be cleaned by solvent washing. The lid liners are ordered separately from Scientific Specialties Service, (cat. no. B68800-70 size 2-11/16").

Glass jars as received, sometimes have a bit of cardboard dust in them. They should be cleaned before baking using DI water. Rinse the jars using DI water. Rinse them 3-4 times and visually inspect them to make sure they look clean and are not cracked. Set the jars with the open end down on clean kimwipes until they dry. Also briefly rinse the caps and set them on clean kimwipes to dry.

When dry, cover each jar with a double thick layer of aluminum foil and set them in the oven to bake. Approximately 10 jars will fit in the oven at one time. Be careful that the jars do not touch the sides or ceiling of the oven. It is also a good idea to always include several folded pieces of aluminum foil every time baking is performed since many pieces of annealed aluminum foil will later be needed. Bake jars for at least 10 hours or as long as 20 hours at 550°C.

Turn the oven off and allow the jars to cool slowly inside the oven. After they are partly cooled, open the oven door and allow them to continue to cool inside the oven. Cooling too fast will cause jars to break from thermal shock.

While waiting for the jars to cool, clean teflon lid liners using hexane and methanol. The solvents are available on campus at the VWR stockroom in the Beckman Institute. Two clean beakers should be dedicated to this process which should be done under a fume hood. I find it easiest to clean the lid liners by doing it one at a time using tongs and two beakers. Fill one beaker with hexane, one with

methanol. Hold the liner with the tongs and dip it into the hexane, swish it around for a minute, then transfer it to the methanol and dip and swish it around. Put the liners on clean kimwipes to dry and cover them with another kimwipe so that they do not collect dust.

When the jars are cool. Use solvent cleaned tweezers to put the teflon liners into the caps and then remove the foil from the jars and close them tightly with the lids. Place the jars back into the boxes that they came out of. When a box has 24 jars in it, tape the box closed and write on the outside "Annealed glass jars - baked at 550°C".

## (5) USING BAKED QUARTZ FILTERS

Never touch the quartz filters, foil liners in petri dishes, or any part of a filter holder that comes in contact with the filters with one's fingers. Use only clean, solvent-rinsed tweezers to touch the filters.

Filter holder parts should be washed in solvents (e.g., hexane, methanol) before use. Everything upstream of the filter should be either metal, glass, or teflon (i.e., no tygon tubing, rubber o-rings or other soft plastics should be used).

It is preferable to transport 47mm diameter filters to the field in their sealed petri dishes and to load filters immediately before sampling. Hi Vol filters may be better served, by loading filter holders in the lab and transporting them to the field in clean, annealed glass petri dishes.

Ideally, field operators will have pieces of annealed aluminum foil to use as a clean surface to work on in the field. Tweezers can be solvent-rinsed in the lab and then transported to the field either wrapped in annealed aluminum foil or kept in annealed glass jars.

Immediately after sampling, quartz filters should be removed (using tweezers) and returned to the petri dish from which it came. The sides of the aluminum foil bottom liner are used to tack down the filter, preventing the abrasion of the top of the filter on the foil lined lid. Wrap each petri dish with teflon tape to seal the dish, and store the filters upright in a cooler to await transport back to lab where they should be kept in a freezer until ready for analysis. Large quartz filters are placed in clean glass jars after sampling and also stored in the freezer until analysis.

If filters must be pre-loaded into filter holders in the laboratory, it becomes necessary to develop a procedure for handling the loaded filter holders for transport to the field. One possibility is to obtain end caps for the filter holders (made out of teflon or metal) and cap the filter holders when transporting to and from the field. It may be advisable to wrap loaded filter holders in annealed aluminum foil for transport to the field. The petri dish can be sent to the field with this package and the filter could be unloaded into the petri dish after sampling.

Note that it is extremely important that the loaded filter holders are not placed in plastic bags or near other sources or organic carbon that would contaminate the filter during transport.

It is also extremely important that samples are clearly labelled with a unique labelling scheme that clearly indicates the volume of air sampled, when, and where the sample was taken. See the General Field Sampling Instructions for more details.